

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Building Energy Codes

Enhancing Energy Efficiency Nationwide

Fiscal Year **2009** Annual Report

Less Energy. Less Cost. Less Carbon.



Building Energy Codes
U.S. Department of Energy



ENHANCING ENERGY EFFICIENCY NATIONWIDE:

Less Energy. Less Cost. Less Carbon.

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*The end result of BECP's work is new and retrofitted homes and businesses with **reduced energy consumption, lower energy bills, and a smaller carbon footprint.***

Dear Stakeholders,

The economic news was bleak throughout most of 2009. News reports regularly touted a lack of consumer spending, industry bailouts, and rising unemployment, not to mention sharp disagreements about how to move forward on issues ranging from health care to climate change.

But amid the bad news were some silver linings, particularly in the energy arena. Gas prices declined significantly from their 2008 highs, and the nation continued to draw on renewable energy sources, generating nearly 11% of electricity in the United States in 2009,¹ and an all-time high of 13% in May.² And notably, upgraded building codes were helping to significantly reduce the amount of energy used to heat, cool, and illuminate hundreds of thousands of homes and commercial buildings, holding even greater promise for the future.

Residential and commercial buildings account for 40%³ of all U.S. energy consumption and more than 70%⁴ of electricity used in the United States. Clearly, effective and enforceable building energy codes and standards can play a critical role in reducing energy consumption, lowering energy bills, and reducing the nation's carbon footprint.

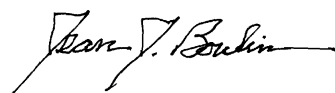
Since 1991, the U.S. Department of Energy's Building Energy Codes Program (BECP) staff have worked with the energy codes community to improve residential and commercial building energy codes and standards. In fact, since its inception, BECP is estimated to have saved the nation over \$14 billion (2009 dollars) in energy costs.⁵

But the issue of improving building energy efficiency picked up steam in 2009. Since his appointment in January, Secretary of Energy Stephen Chu has touted it in various forums, even in a June *Rolling Stone* magazine article!

And in February, Congress passed the \$787 billion American Recovery and Reinvestment Act of 2009. The Recovery Act specifically allocates funding to support state building energy-efficiency projects and provide various tax incentives. Within this effort, DOE is providing funding to help states better prepare to meet code-compliance requirements and improve energy-efficiency.

As we look to 2010 and beyond, we anticipate being in the spotlight once more. BECP is committed to increasing the energy-efficiency requirements of codes and is giving particular attention to those model codes cited in the Recovery Act. And this work has tangible impact—adopting stricter residential and commercial building codes is expected to save over \$30 billion annually by 2030, reduce carbon dioxide emissions by roughly 3%, and prevent the need to construct hundreds of power plants.⁶

In the following pages we share with you the advances we've made in the last fiscal year. Thank you for your continued efforts to support building energy efficiency and remember, when it comes to energy, cost, and carbon, less really is more.



Jean Boulton
Building Energy Codes
U.S. Department of Energy

Forward Thinking



Upgrading residential and commercial codes by 30% in 2010 and 50% in 2020, as compared to the 2006 IECC and Standard 90.1-2004, will save as much energy as 260 medium-size power plants produce in a year, put \$30 billion annually back into building owners' pockets by 2030, and reduce projected national carbon dioxide emissions by roughly 3% in 2030.⁷



Forward Looking

Read on to learn more about BECP's work in FY09 to increase energy efficiency in our nation's buildings.

- ✓ 30/30 Vision: Residential Code Development
- ✓ 30/30 Vision: Commercial Code Development
- ✓ Outreach, Education, and Training
- ✓ Code-Compliance Software Support

¹ U.S. Energy Information Administration. Electric Power Monthly, March 2010 Edition. Accessed March 18, 2010, at http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html.

² Renewable Energy World. August 19, 2009. "Another Record for U.S. Renewable Electricity." Accessed March 18, 2010, at <http://www.renewableenergyworld.com/rea/news/article/2009/08/another-record-for-u-s-renewable-electricity>.

³ U.S. Energy Information Administration. 2008. *Annual Energy Review 2008*. Figure 2.1a, "Energy Consumption by Sector Overview." Accessed March 18, 2010, at <http://www.eia.doe.gov/emeu/aer/consump.html>.

⁴ U.S. Energy Information Administration. 2008. *Electric Power Annual Report*. Table 7.2., "Retail Sales and Direct Use of Electricity to Ultimate Customers by Sector, by Provider, 1997 through 2008 (Megawatt Hours)." Accessed March 18, 2010, at <http://www.eia.doe.gov/cneaf/electricity/epa/epat7p2.html>.

⁵ Belzer D, M Halverson, and S McDonald. Pacific Northwest National Laboratory, unpublished data, February 2010.

⁶ Belzer D, M Halverson, and S McDonald. 2009. *A Retrospective Analysis of Commercial Building Energy Codes: 1990-2008*, Draft. Buildings Energy Codes Program, Pacific Northwest National Laboratory, Richland, Washington.

⁷ Ibid.

ENHANCING ENERGY EFFICIENCY NATIONWIDE:

30/30 Vision: Residential Code Development

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*After gaining **12-15% improved energy efficiency** in the 2009 IECC, in FY09 **BECP** focused on reaching the next and more difficult half of the **30% goal**.*

IMPROVING THE IECC

In Fiscal Year 2009 (FY09), Building Energy Codes Program (BECP) staff continued their dedicated support for the 30% Residential Codes Initiative, which is embraced by the U.S. Department of Energy (DOE) and others. The Initiative focuses on improving the energy efficiency of the residential energy code adopted by most states—the International Energy Conservation Code® (IECC)—by 30%, relative to the 2006 IECC, by the year 2012.

The beginning of FY09 saw the end result of the hugely successful International Code Council® (ICC) Code Development Cycle, which yielded the 2009 IECC. Compared to the 2006 IECC, the 2009 code boasts an unprecedented gain in energy efficiency—12-15%. FY09 work by BECP's residential team centered on reaching the next, and more difficult, half of the 30% goal.

COLLECTIVE ENERGY

Reaching the second half of the 30% goal is accompanied by two primary challenges: most of the low-hanging fruit increases in energy efficiency in the 2006 IECC were addressed in producing the 2009 IECC, and the IECC development process was streamlined in 2009. The latter, while an overall positive change, resulted in a more aggressive timeline to draft code-change proposals based on the 2009 IECC. To overcome these challenges, DOE turned to its strongly built relationships with energy codes community members across the nation.

To kick off the community effort, DOE hosted the first of a series of meetings focused on developing a set of IECC code-change proposals that could be supported by a broad range of interested and affected parties. The kick-off meeting, held in Washington, D.C.,

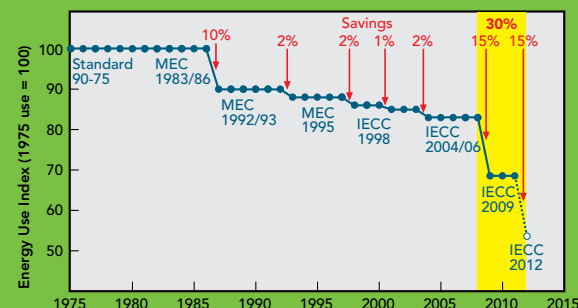
welcomed 50 professionals, representing almost 40 organizations involved in the energy-code-making process. As a result of this collaborative effort, as well as DOE's own code-change proposal development work, DOE submitted a total of 24 code-change proposals to the ICC in the summer of 2009.

CHANGE IS GOOD

DOE's proposals make gains toward energy savings from several angles. Examples include proposals designed to:

- Achieve the bulk of the 30% goal in one package via multiple components, such as proposal EC13, a major DOE proposal relating to residential buildings and recommended for approval by the IECC Code Development Committee.
- Increase stringency in several areas already covered by the code, such as through higher envelope R-value requirements, a more stringent duct pressure test, and more high-efficacy lamps and/or fixtures.
- Make sure building envelopes are inspected against a checklist of air-sealing measures and pressure tested to ensure proper sealing against air leaks.
- Limit the amount of hot water that gets stranded in pipes between uses by encouraging short hot-water-pipe runs and small-diameter pipes.
- Use heat captured from home air-conditioning systems to heat water.
- Limit the amount of west-facing glazing to save cooling energy, reduce peak electric loads, improve comfort, and potentially allow for smaller air-conditioning equipment—at a measurable cost savings.

A Brief History of Residential Codes



DOE has played a strong role in the decrease in residential building energy use over the last four decades.

What's Next?

BECP staff are analyzing and evaluating code-change proposals considered at October's Initial Action hearings and will provide comments to the ICC by July 1, to be considered at the Final Action hearings in the fall of 2010. The upcoming hearings will render the final disposition on the 2012 IECC, which DOE and others are working to ensure is at least 30% more stringent than the 2006 version.

After some preliminary planning in FY09, DOE is seeking public input in FY10 to help develop and publish energy standards for new manufactured housing by December 2011. Manufactured housing energy-efficiency standards have remained static since 1994, while site-built model codes have advanced significantly.

ENHANCING ENERGY EFFICIENCY NATIONWIDE:

30/30 Vision: Commercial Code Development

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DOE continued its close, collaborative relationship with ASHRAE in FY09, working toward their shared goal to achieve 30% savings in new commercial buildings.

ADVANCING ASHRAE

DOE continued its close, collaborative relationship with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the Illuminating Engineering Society of North America (IES) in FY09, working toward their shared goal to achieve 30% savings in new commercial buildings by developing ANSI/ASHRAE/IES⁸ Standard 90.1-2010 to be 30% more energy efficient than Standard 90.1-2004. In FY09, BECP commercial building experts continued to serve on ASHRAE committees, actively participating in the ASHRAE Standard development process.

As of the end of FY09, 88 addenda were approved for the Standard: 43 to Standard 90.1-2007 and 45 addenda to Standard 90.1-2004. Simulations showed savings in different building types as follows.

- Retail buildings: 10-16%
- Warehouses: 15%
- Offices: 11%
- Schools: 11%
- Outpatient healthcare: 11%
- Apartment buildings: 9%
- Lodging: 9%
- Food Service: 1-6%.

The ranges above demonstrate progress, and are reflective of a variety of climate zones.

ADVANCING THE IECC

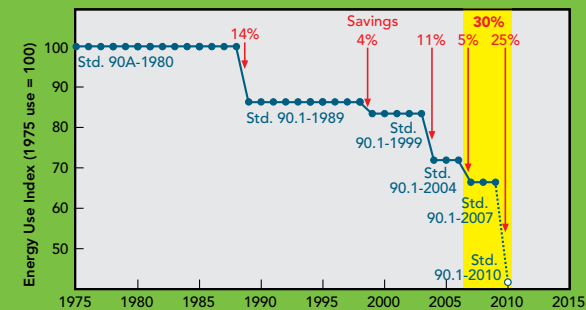
In addition to its focus on the ASHRAE Standard, BECP's commercial team joins ASHRAE and others in lending a hand in proposing commercial provisions to Chapter 5 of the IECC. To this end, in FY09 DOE developed code-change proposals for the IECC designed to keep the 2012 IECC technically compatible with ANSI/ASHRAE/IES Standard 90.1-2010.

Most notable among the code-change proposals developed for the IECC was EC147, an omnibus proposal resulting from a collaboration of DOE, the New Buildings Institute, and the American Institute of Architects (AIA). The goal of the omnibus proposal, coupled with additional proposals submitted to the 2012 IECC, is a savings of 30% over the 2006 IECC. In October, the ICC recommended several code-change proposals for approval, including EC147.

The joint proposal offers measures to achieve greater energy efficiency through a cool roof requirement for buildings in the southern tier of the country. EC147 also recommends building a new section into the code, offering designers and developers a choice of three different paths that will allow flexibility when considering the building site, construction methods, environmental conditions, and costs:

- Use more efficient HVAC equipment.
- Implement a more efficient lighting system.
- Use renewable energy.

A Brief History of Commercial Codes



DOE has played a strong role in decreasing commercial building energy use over the last four decades.

What's Next?

ASHRAE will approve final changes for Standard 90.1-2010 in June 2010. BECP will complete its final progress indicator for ASHRAE and DOE in October 2010 and ASHRAE will publish Standard 90.1-2010 in December 2010. DOE will then publish a preliminary determination for Standard 90.1-2010 in January 2011, based on work done for the progress indicator.

DOE's final determination, to be published in 2011, will trigger a two-year time period for states to review Standard 90.1-2010 and update their commercial code to meet or exceed Standard 90.1-2010. And then the cycle will begin again. DOE's goal for Standard 90.1-2013 is 40% savings over Standard 90.1-2004.

⁸ The American National Standards Institute/ASHRAE/IES.

Outreach, Education, and Training

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*BECP's efforts are **community driven** and focus on boosting building energy **code adoption**, proper implementation, compliance, and enforcement.*

CRANKING UP COMPLIANCE

As part of its FY09 activities, BECP staff began development of a mechanism for states and jurisdictions to accurately and consistently assess how well buildings are complying with their building energy codes. With the input of state energy officials and other stakeholders, BECP began building a suite of guidelines, training, and tools to help states demonstrate their compliance levels.⁹

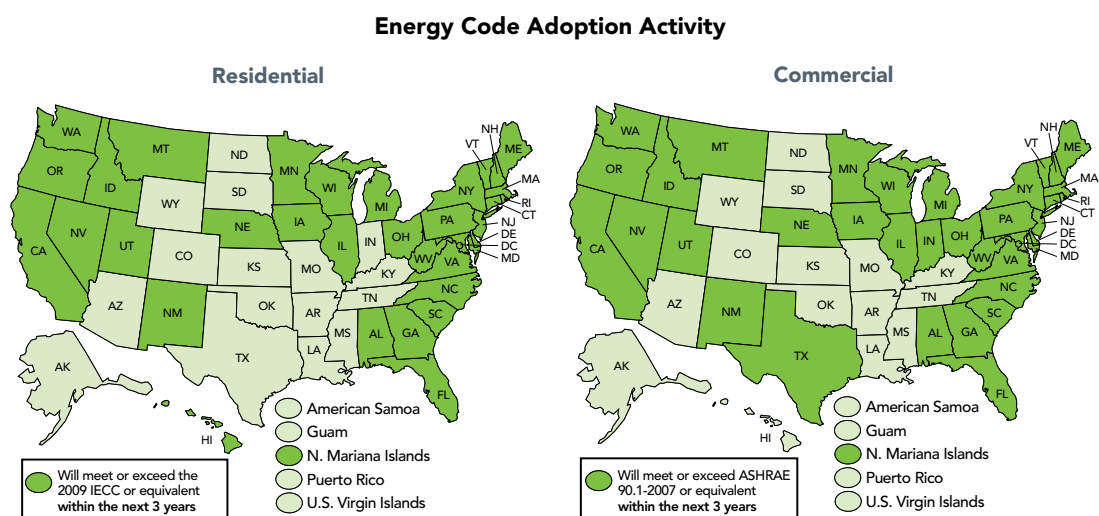
This toolbox is designed to help state officials, jurisdictional staff, architects and designers, builders and contractors, and engineers:

- Measure and improve code compliance.
- Develop a valid building sample.
- Evaluate building sample data.
- Fund and conduct onsite evaluations.
- Use checklists and aggregate audit results.
- Conduct annual compliance measurements.
- Comply with alternative codes and home-rule state codes.
- Obtain jurisdictional buy-in.
- Communicate state activities and lessons learned.

NATIONWIDE ANALYSES

In a first-of-its-kind study, BECP calculated how much energy would be saved per home, per year, per state, per climate zone if each state updated its current state building energy codes to the 2009 IECC. The report demonstrates the value of more stringent energy codes in dollars and cents. For example, residents in Omaha, Nebraska could potentially save \$236 per house per year if Nebraska upgraded to the 2009 IECC.¹⁰

An analogous study using percent improvement, rather than dollar savings, was conducted comparing ASHRAE Standard 90.1-2007 with the commercial code in each state as of June 2009.¹¹ For example, if Alabama were to adopt Standard 90.1-2007, non-residential new building owners of Montgomery would save 13.6% more energy and 14.1% in energy costs.



Source: BECP's Status of State Codes, http://www.energycodes.gov/implement/state_codes/index.stm

More than half the states and U.S. Territories are on track to meet or exceed the 2009 IECC and ASHRAE Standard 90.1-2007 by 2012.

⁹ For more information, see <http://www.energycodes.gov/news/arra/>.

¹⁰ Impacts of the 2009 IECC for Residential Buildings at State Level (September 2009)

¹¹ Impacts of Standard 90.1-2007 for Commercial Buildings at State Level (September 2009)

Technical Assistance and Training

Energy Codes 2009	226 attendees from 38 states and territories
Website hits	Over 45 million
Webcast participants	Over 10,000
AIA credit recipients	Over 1,000
Newsletter subscribers	About 60,000
Technical support inquiries	Over 3,200
State Technical Assistance	Catered assistance was provided to: <ul style="list-style-type: none"> • Hawaii • Massachusetts • Michigan • New York • Washington • Wisconsin • Texas as well as the territory of Puerto Rico and jurisdiction of Chicago.

Outreach

DOE's BECP involves staff from Pacific Northwest National Laboratory, the Building Codes Assistance Project, and the National Energy Technology Laboratory. BECP also relies on its strong collaboration with key stakeholder groups.

PNNL

- Stakeholder Outreach
- Technical Assistance (states and building industry)
- Training
- Website

BCAP

- Advocacy

NETL

- State and Regional Outreach

Code-Compliance Software Support

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BECP's code-compliance
software products were accessed
nearly **200,000 times** via the
web in FY09, more than a
three-fold increase from four
years earlier.

USER FRIENDLY

BECP develops and makes available easy-to-use, state-specific code-compliance software designed to support the IECC and ANSI/ASHRAE/IES Standard 90.1, which are the basis for most state codes. The code-compliance software, REScheck™ and COMcheck™, makes demonstrating and checking compliance with energy codes easy, and are available at no cost to the energy codes community through www.energycodes.gov. To supplement REScheck and COMcheck, BECP also provides free videos, training materials, and compliance manuals.



USER FOCUSED

We continually update our software to meet the needs of the energy codes community.

In FY09, REScheck was upgraded to include:

- Support for the 2007 IECC Supplement and the 2009 IECC
- Revised Wisconsin state code
- Modifications for the city of Chicago
- Email-based login and version update checking.

In FY09, COMcheck was upgraded to include:

- 90.1-2007 support in COMcheck-Web
- Extensive redesign of mechanical system inputs
- Modifications for the city of Chicago
- Email-based login and version update checking.

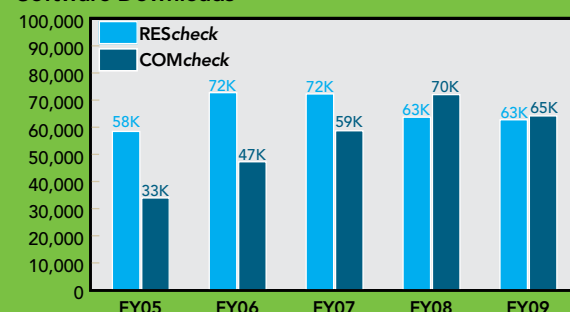
USER APPROVED

Overall software use remained fairly steady in FY09. REScheck and COMcheck were downloaded 127,095 times in FY09 compared to 133,315 times in FY08. REScheck-Web and COMcheck-Web were accessed via www.energycodes.gov 199,485 times by 33,332 active, registered users in FY09, compared to 200,737 times from 27,173 users in FY08.



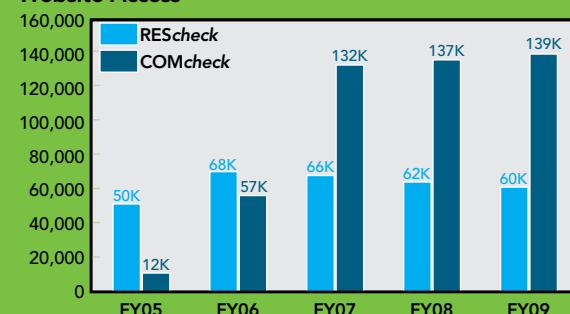
REScheck and COMcheck downloads

Software Downloads



Software Website Access

Website Access





The U.S. Department of Energy's Building Energy Codes Program is an information resource on national model energy codes. We work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes.

BECP Website:

www.energycodes.gov

BECP Technical Support:

techsupport@becp.pnl.gov

www.energycodes.gov/support/helpdesk.php

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